(b) Safety valves for use on pressure vessels in which steam or pressure is generated shall comply with the requirements of §54.15–10. Rupture discs used in lieu of these safety valves, as provided for in paragraph (a) of this section, shall comply with the requirements of §54.15–13.

(c) The relieving capacity of evaporator safety valves required by paragraph (a) of this section shall be at least equal to the capacity of the orifice fitted in the steam supply to the evaporator. The orifice capacity shall be determined in accordance with the formula in paragraph (c) (1) or (2) of this section as appropriate:

(1) Where the set pressure of the evaporator shell safety valve is 58 percent or less than the setting of the safety valve in the steam supply:

$W=51.45AP$

(2) Where the set pressure of the evaporator shell safety valve exceeds 58 percent of the setting of the safety valve on the steam supply:

$W=105.3A\sqrt{P_1(P-P_1)}$

where:

W=The required orifice capacity, in pounds per hour.
A=Cross-sectional area of rounded entrance orifice, in square inches. The orifice shall be installed near the steam inlet or the coils or tubes and where no orifice is employed the area used in the formula shall be that of the inlet connection or manifold.
P=Set pressure of steam supply safety valve, in pounds per square inch, absolute.
P_1=Set pressure of evaporator shell safety valve, in pounds per square inch, absolute.

(d) The relieving capacity of safety valves on unfired steam boilers shall not be less than the maximum generating capacity of the unfired steam boiler as certified by the manufacturer.

(e) On new installations and where the orifice size of an existing unfired steam boiler or evaporator is increased, an accumulation test shall be made by closing all steam outlet connections except the safety valves for a period of five minutes. When conducting the accumulation test, the water shall be at the normal operating level and the steam pressure shall be at the normal operating pressure, and while under this test the pressure shall not rise more than 6 percent above the safety valve setting.

(f) A heat exchanger with liquid in the shell and the heating medium in the tubes or coils, shall be fitted with a liquid relief valve meeting the requirement of §54.15–5.

(g)(1) A heat exchanger with steam in the shell and liquid in the tubes or coils at a pressure exceeding that in the shell, shall have a liquid relief valve fitted to protect the shell against excess pressure.

(2) The discharge capacity of such relief valves shall be calculated on the basis of the discharge from one tube using the difference in pressures between that in the shell and that in the tubes and shall be not less than that determined by the following formula:

$Q=29.81KD^2\sqrt{P_1-P_2}$

where:

Q=Required relief valve discharge capacity, in gallons per minute, based on relief valve set pressure.
P_1=Pressure in the tube or coils, in pounds per square inch.
P_2=Set pressure of the shell relief valve, in pounds per square inch.
D=Internal diameter of the largest tube or coil, in inches.
K=Coefficient of discharge=0.62.

[CGFR 68–82, 33 FR 18828, Dec. 18, 1968, as amended by CGD 72–206R, 38 FR 17226, June 29, 1973]

§54.15–25 Minimum relief capacities for cargo tanks containing compressed or liquefied gas.

(a) Each tank shall be fitted with one or more safety relief valves designed, constructed, and flow tested in accordance with subpart 162.017 or 162.018 in subchapter Q (Specifications) of this chapter. Valves conforming to specification subpart 162.017 shall be limited to use on tanks whose maximum allowable working pressure is not in excess of 10 pounds per square inch. With specific approval of the Commandant, such valves may be connected to the vessel in lieu of being directly fitted to the tanks.

(b) The discharge pressure and the maximum overpressure permitted shall be in accordance with §54.15–5.

(c) The rate of discharge for heat input of fire must meet the following formula:

$Q=FGA^{0.82}$

where:

Q=minimum required rate of discharge in cubic meters (cubic feet) per minute of air at standard conditions 15 °C and 103 kPa (60 °F and 14.7 psia).

F=fire exposure factor for the following tank types:

F=1.0 for tanks without insulation located on the open deck.

F=0.5 for tanks on the open deck having insulation that has approved fire proofing, thermal conductance, and stability under fire exposure.

F=0.5 for uninsulated independent tasks installed in holds.

F=0.2 for insulated independent tanks in holds or for uninsulated independent tanks in insulated holds.

F=0.1 for insulated independent tanks in inerted holds or for uninsulated independent tanks in inerted, insulated holds.

F=0.1 for membrane and semi-membrane tanks.

G=gas factor of:

$$"G = [(177/LC)(\sqrt{ZT/M})] \quad \text{SI units}$$

$$G = [(633,000/LC)(\sqrt{ZT/M})] \quad \text{English units}"$$

where:

L=latent heat of the material being vaporized at the relieving conditions, in Kcal/kg (Btu per pound).

C=constant based on relation of specific heats (k), Table §54.15–25(c) (if k is not known, C=.606(315)).

Z=compressibility factor of the gas at the relieving conditions (if not known, Z=1.0).

T=temperature in degrees K=(273 + degrees C) (R=(460 + degrees F)) at the relieving conditions (120% of the pressure at which the pressure relief valve is set).

M=molecular weight of the product.

A=external surface area of the tank in m^2 (sq. ft.) for the following tank types:

For a tank of a body of revolution shape:

A=external surface area.

For a tank other than a body of revolution shape:

A=external surface area less the projected bottom surface area.

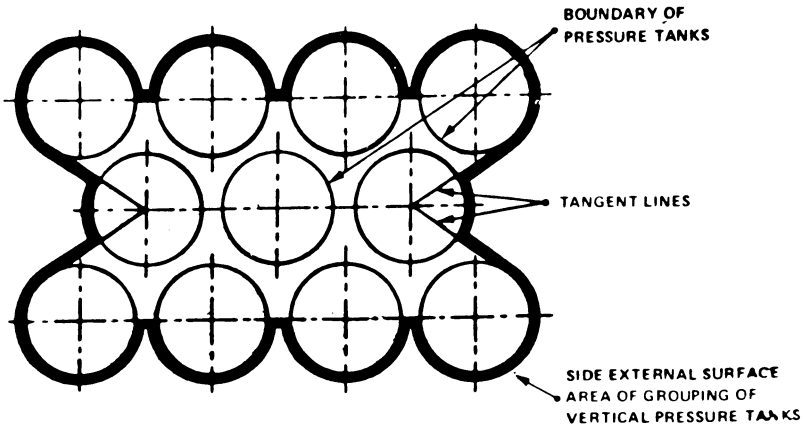
For a grouping of pressure vessel tanks having insulation on the vessel's structure:

A=external surface area of the hold without the projected bottom area.

For a grouping of pressure tanks having insulation on the tank:

A=external surface area of the pressure tanks excluding insulation, and without the projected bottom area.[1]

[1] Figure 54.15–25(c) shows a method of determining the side external surface area of a grouping of vertical pressure tanks.



SIDE EXTERNAL SURFACE AREA OF GROUPING OF VERTICAL PRESSURE TANKS

Figure 54.15–25 (c)

TABLE 54.15–25(c)—CONSTANT C

k	C	
1.00	.606	(315)
1.02	.611	(318)
1.04	.615	(320)
1.06	.620	(322)
1.08	.624	(324)
1.10	.628	(327)
1.12	.633	(329)
1.14	.637	(331)
1.16	.641	(333)
1.18	.645	(335)
1.20	.649	(337)
1.22	.652	(339)
1.24	.658	(341)
1.26	.660	(343)
1.28	.664	(345)
1.30	.667	(347)
1.32	.671	(349)
1.34	.674	(351)
1.36	.677	(352)
1.38	.681	(354)
1.40	.685	(356)
1.42	.688	(358)
1.44	.691	(359)
1.46	.695	(361)
1.48	.698	(363)
1.50	.701	(364)
1.52	.704	(366)
1.54	.707	(368)
1.56	.710	(369)
1.58	.713	(371)
1.60	.716	(372)
1.62	.719	(374)
1.64	.722	(376)
1.66	.725	(377)
1.68	.728	(379)
1.70	.731	(380)
1.72	.734	(382)
1.74	.736	(383)
1.76	.739	(384)
1.78	.742	(386)
1.80	.745	(387)

TABLE 54.15–25(c)—CONSTANT C—Continued

k	C	
1.82	.747	(388)
1.84	.750	(390)
1.86	.752	(391)
1.88	.755	(392)
1.90	.758	(394)
1.92	.760	(395)
1.94	.763	(397)
1.96	.765	(398)
1.98	.767	(399)
2.00	.770	(400)
2.02	.772	(401)
2.20	.792	(412)

(c–1) For an independent tank that has a portion of the tank protruding above the open deck, the fire exposure factor must be calculated for the surface area above the deck and the surface area below the deck, and this calculation must be specially approved by the U.S. Coast Guard, Office of Design and Engineering Standards (CG–ENG)..

(d) In determining the total safety valve relieving capacity, the arrangement and location of the valves on the tank will be evaluated. The valves shall be placed so that a number of valves sufficient to provide the required relieving capacity shall always be in communication with the cargo vapor phase. The possible motions which the tank may see in its intended service and attendant changes in cargo liquid level will be considered. Shut off

valves shall not be installed between the vessel and the safety relief valves. Manifolds for mounting multiple relief valves may be fitted with acceptable interlocking shut off valves so arranged that the required capacity of discharge will be ''lined up'' at all times.

(e)(1) Each safety relief valve shall be tested in the presence of a marine inspector before being placed in service except as noted otherwise in paragraph (e)(2) of this section. The test shall satisfactorily show that the valve will start to discharge at the required minimum pressure.

(2) Each safety relief valve fitted with a breaking pin and rupture disk need not be tested in the presence of a marine inspector before being placed in service. In lieu thereof, a certificate shall be furnished with the valve attested to by the manufacturer that the test requirements of paragraph (e)(1) of this section have been met.

[CGFR 68–82, 33 FR 18828, Dec. 18, 1968, as amended by CGD 74–289, 44 FR 26007, May 3, 1979; CGD 82–063b, 48 FR 4781, Feb. 3, 1983; CGD 95–072, 60 FR 50462, Sept. 29, 1995; CGD 96–041, 61 FR 50728, Sept. 27, 1996; USCG–2004–18884, 69 FR 58346, Sept. 30, 2004; USCG–2007–29018, 72 FR 53965, Sept. 21, 2007; USCG–2009–0702, 74 FR 49228, Sept. 25, 2009; USCG–2012–0832, 77 FR 59777, Oct. 1, 2012]

Subpart 54.20—Fabrication by Welding

§ 54.20–1 Scope (modifies UW–1 through UW–65).

(a) Pressure vessels and vessel parts that are fabricated by welding shall be as required by paragraphs UW–1 through UW–65 of section VIII of the ASME Boiler and Pressure Vessel Code (incorporated by reference; see 46 CFR 54.01–1) except as noted otherwise in this subchapter.

(b) [Reserved]

[CGFR 68–82, 33 FR 18828, Dec. 18, 1968, as amended by USCG–2003–16630, 73 FR 65170, Oct. 31, 2008]

§ 54.20–2 Fabrication for hazardous materials (replaces UW–2(a)).

(a) Pressure vessels containing hazardous materials as defined in § 150.115 of this chapter must be of the class and construction required by subchapter D, I, O, or, when not specified, of a class determined by the Commandant.

(b) Class III pressure vessels must not be used for the storage or stowage of hazardous materials unless there is specific authorization in subchapters D, I, or O.

[CGD 77–147, 47 FR 21810, May 20, 1982]

§ 54.20–3 Design (modifies UW–9, UW–11(a), UW–13, and UW–16).

(a) Fabrication by welding shall be in accordance with the provisions of this part and with part 57 of this subchapter.

(b) Welding subject to UW–11(a) of section VIII of the ASME Boiler and Pressure Vessel Code (incorporated by reference; see 46 CFR 54.01–1) shall be modified as described in § 54.25–8 for radiographic examination.

(c) A butt welded joint with one plate edge offset, as shown in Figure UW–13.1(k) of section VIII of the ASME Boiler and Pressure Vessel Code, may only be used for circumferential joints of Class II and Class III pressure vessels.

(d) Attachment welds for nozzles and other connections shall be in accordance with UW–16 of section VIII of the ASME Boiler and Pressure Vessel Code. When nozzles or connections are made to pressure vessels, as shown in Figure UW–16.1 (a) and (c) of the ASME Code, and are welded from one side only, backing strips shall be used unless it can be determined visually that a full penetration weld has been achieved.

(e) When fabricating by welding the minimum joint requirements shall be as specified under the column headed ''minimum joint requirements'' in Table 54.01–5(b) for various classes of pressure vessels.

(f) Joints in Class II or III pressure vessel cargo tanks must meet the following:

(1) Category A and B joints must be type (1) or (2).

(2) Category C and D joints must have full penetration welds extending through the entire thickness of the vessel wall or nozzle wall.

[CGFR 68–82, 33 FR 18828, Dec. 18, 1968, as amended by CGD 77–147, 47 FR 21810, May 20, 1982; CGD 85–061, 54 FR 50964, Dec. 11, 1989; USCG–2003–16630, 73 FR 65170, Oct. 31, 2008]